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Gender Differences in Gross and Fine Motor Abilities in Preschool Aged Children in West Virginia

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Abstract

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By Kelly Pennington

The purpose of this study was to investigate gender differences in gross and fine motor abilities in preschool aged children in West Virginia. Subjects consisted of 21 males and 16 females. Data was collected via the West Virginia Educare Initiative using the Carolina Curriculum for Preschoolers with Special Needs. Results of this study indicate that there are no significant gender differences in either gross motor or fine motor abilities in preschool aged children.

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In the past, preschool aged children were conventionally cared for by their mothers in the home. If the mother was unable to care for her child, then a member of the extended family would do so. However, the expansion of employment opportunities for women has had a major impact upon the lives of their preschool aged children, forcing the parent or parents to seek child care outside the home (Lombardo & Lombardo, 1983).

The increase of mothers in the labor force has led to an increasing demand for early childhood education services for their preschool aged children. As reported in 1989 by the Ford Foundation, "the United States now has some nine million children under age six whose mothers are in the labor force" (Ford Foundation, 1989, p.v). In 1991 Boyer stated, "more than four million children started school, not as kindergartners or first graders, but as three- and four-year-olds off to their first day of 'preschool' (p. 47)."

Preschool, however, is not only for the less fortunate and those from single parent households or even for the child whose parents both work. Preschool appears to be attracting families from all social and economic backgrounds. "Preschools are schools that provide programs for children who are younger than kindergarten age, typically between the ages of two and five. These programs provide quality care, socialization, enrichment, play and education" (Herman, 1998, p.6). According to Brenner, "Good preschool programs reflect Piagetian principles in the rich variety of materials they make available to children in their encouragement of dramatic and other kinds of play, and in

the ‘hands on’ activities that give children the opportunity to explore the world around them in many ways” (1991, p.31).

Because of what we know about the impact of early experience on a child’s long-term learning potential, quality educational programs have proven to be of great value to a child’s social, cognitive, language, and motor development (Herman, 1998). Selma Frailberg referred to them as the “magic years” (Brenner, 1990, p. 28). Quality preschool programs have also proven to be cost effective in the prevention of school failure in later years and a number of other problems, including but not limited to, placement in special education, dropping out of school, delinquency, and teenage pregnancy (Beatty, 1995).

According to the West Virginia Kids Count Data Book, West Virginia began to subsidize the cost of child care in 1969 in order for families of low-income to join in the work force. By 1979, the state was supporting 4,500 children in child care. During that time, the criterion for child care licensing was improved substantially, and training programs were implemented for all care givers.

In 1999, West Virginia had 441 centers that were licensed, an increase from 300 in 1997. In 1999, there were 13,301 children whose child care was financed by the state, an increase of 3,740 from 1996. As of 1999, only one county was reported as having no licensed child care facility (Kids Count Data Book, 1999).

Because of unspent welfare funds (savings due to the growth of the economy and implementation of welfare reform policies which decreased the number of welfare recipients) West Virginia’s Child Care Program has profited tremendously. “$10 million in improvements for 1999 and $22 million committed for the year 2000” (Kids Count,

1999, p.6). Some of these improvements include "special grants to centers, an increase in the eligibility level to 150 percent of the 1999 federal poverty level, and complete funding and implementation for statewide coverage of six child care resource and referral agencies who can provide the infrastructure necessary for a quality system" (Kids Count, 1999, p.6). One major improvement of greatest importance is the child care training program for the care providers of infants and toddlers. Once implemented, higher fees will be paid to graduates of the program (Kids Count, 1999).

According to Deborah Phillips, child care expert, "quality lies with the caregiver" (Kids Count, p.6). When child care providers are better educated and trained, the quality of care increases due to the ability to interact more productively with young children. According to a longitudinal study on early child care conducted by the National Institute of Child Health and Human Development (NICHD), findings suggest the following as substantial elements of quality care, "care givers who are highly sensitive to the children in care; small caregiver to child ratio; small group size; the caregivers' level of education; and the safety and stimulation of the physical setting" (Kids Count, 1999, p.7).

According to West Virginia's Kids Count Data Book, a quality standard ratio of caregivers to infants is 1:3. However in West Virginia, the average ratio is 1:4. The quality standard for three year olds is 1:7, yet West Virginia allows one teacher for up to ten three-year-olds. Given the importance of proper training before providing care, West Virginia's program has proven to be inadequate (1999).

In an attempt to improve the quality of services for young children, the WV Study Commission on Services for Young Children was created. Through this initiative, West

Virginia Educare was developed. In 2001, the Governor's Cabinet on Children and families was allotted $1 million to pilot the Educare initiative. "West Virginia Educare (WVE) seeks to improve preschool opportunities for children under five. It would establish standards for quality early learning programs and provide additional funding to programs that meet those standards" (West Virginia Educare, 2001, p.2). Educare is meant to enhance, rather than supersede the services that are already in existence.

Educare programs will be readily available in Head Start centers, public schools, private preschools, WV Birth to Three programs, and child care programs (centers and family based), and are available to any child up to 5 years of age. "Educare programs will provide part and full-day options, year round availability, meaningful family involvement, services for children with disabilities, appropriate curriculum and environment, and trained and qualified staff" (Policy and Funding Recommendations for West Virginia, 1998, p.2). Educare is based on a parents' capacity to pay, and enrollment is entirely voluntary. This affords many parents the opportunity to enroll their child in a quality early childhood education program that they might otherwise be unable to do.

Importance of Motor Development

School readiness is defined as a "child's ability to meet the task demands of school, such as sitting quietly, and to assimilate the curriculum content at the time of entry into the formal school system" (Doherty, 1997). Appropriate motor development is an essential component for school readiness. Research has shown that school readiness is a predictor of a child's ability to benefit from academic instruction in early grades of elementary school, which also predicts the completion of high school (Doherty,

1997). Before entering kindergarten, children are expected to have a certain level of motor skills. A great deal of the work in kindergarten involves painting, cutting, pasting or gluing, drawing, tracing, using a pencil, constructing with paper or blocks, etc. Karnofsky & Weiss, 1993). To perform these tasks, motor skills are required. Since kindergarten is now an integral part of the elementary school's curriculum, the focus has shifted from social to cognitive and academic, thus making quality preschool programs an essential element for school readiness (Nurss, 1987).

Across time, research has shown that the need for sensory and motor experiences in childhood are essential to healthy human brain development, as well as the basis for all higher-level learning and skill acquisition (Shilts, 2000, p.10). When a child is born, he or she has very little control over body muscles. However, before long, with the brain and muscles working together, a child progresses rapidly from crawling to standing, walking, running, and possibly skipping. During this critical stage, neural pathways mature via the myelinization process (Leppo, Davis, & Crim, 2000). "Myelin, a fatty insulating substance, covers axons and expedites the transmission of neural impulses in a predetermined pattern. The process is most rapid from birth to age 4, then continues at a slower pace until around age 20" (Leppo et al., 2000, p.142). The process of myelinization enables children to gain control over their motor functions and sensory abilities, as well as facilitates their cognitive functioning (Leppo et al., 2000). "Everyday a baby's motor skills are improving, which indicates the brain, muscles, and eyes are working smoothly together" (Sinclair, 1973).

Gross Motor Development

Given that a child's motor development advances from gross to fine, in the first two years of a child's life, many gross motor components emerge (Lowrey, 1986). Gross motor skills involve the movement and control of large muscle groups for sitting, crawling, and walking. In the beginning, movements have no pattern or organization and involve the entire body. However, movements become more refined as the child continues to develop. Although the rate of developmental progression is not as rapid during the preschool years as it was in the infancy, the completion and refinement of gross motor skills continues (Tudor, 1981). There is little basic change in neuromuscular development; reflexive patterns remain basically the same, myelinization continues, and muscle fibers amplify in size and strength with use.

Preschool motor development produces all the essential patterns of movement needed for later childhood movements (Nuttall, Romero, & Kalesnik, 1992). According to Miller, "more than half of American children are inactive on a regular basis and are overweight" (1999, p.58). Childcare providers need to be aware that active young children, in addition to undergoing brain development, are also forming habits for long-term health benefits. By age three, developmental progression is reflected in the refinement of skills that had been acquired in the toddler years. Primary achievements of the 3-year-old include the ability to alternate feet while going upstairs; ride a tricycle using pedals (Lowrey, 1986); walk backward; throw a ball while standing without losing his balance; jump from a height of several inches; walk on tiptoes; and run paying little attention to his feet (but lacking full control in starting, stopping, and turning) (Tudor, 1981).

At age four, the preschooler refines mobility by hopping on one foot; increasing stride length and synchrony of movements (Nuttall et al., 1992); running on tiptoes and with more control in starting, stopping and turning; ability to bounce a ball and catch it with his arms flexed; ability to balance on one foot for three to five seconds; can turn sharp corners on his or her tricycle, while pedaling faster; and is able to climb things such as ladders, trees, and playground equipment (Tudor, 1981).

By the time the preschooler reaches age five, more mature patterns of mobility are expected. As the child runs, arm movements are integrated to look more adult like. Skipping is also experimented at this age, but the pattern looks more like separate hops and steps than a fully synchronized skip (Nuttall et al., 1992). Due to the increase of balance on a smaller foundation of support, the 5-year-old can also march well.

While it's possible for a child to function in life without these gross motor skills, a delay in development could be an indication of generalized developmental problems in later life(Howard, Williams, & Port, 1997). Young children with neuromotor impairments are physically restricted which may impede development across other areas such as cognitive, social-emotional, and communication (Jones, Horn, & Warren, 1999). "The need for quality gross-motor experiences during the preschool years is recognized by the American Medical Association, the American Academy of Pediatrics, the President's Council on Physical Fitness, the National Association for the Education of Young Children, and the American Alliance for Health, Physical Education, Recreation, and Dance" (Miller, 1999, p.59).

Fine Motor Development

Fine motor development refers to learning tasks and skills that require the use of small muscle groups (Early Childhood Essential Elements, 1984). The development and refinement of tool use has proven to be the hallmark of fine motor performance during the preschool years. "The gradual refinement is facilitated by increased speed, strength, and coordination of small muscle groups" (Howard et al., 1997, p. 84). With a variety of reach, grasp, and release patterns available, the child is able to investigate new contingencies. McLaughlin and Morgan reported "fine motor-adaptive behavior is dependent at this age on the child's previous establishment of basic relationships and his perceptual abilities of dimension, shape, depth, and memory of sequencing" (Tudor, 1981, p. 461).

The three-year-old child is satisfied for a longer amount of time in more sedentary activities. He or she can use crayons correctly and is more concerned with the finer manipulation of play materials (Tudor, 1981). The three-year-old is able to build a tower of 9 to 10 blocks; completely dress and undress; can fold a piece of paper in half but cannot fold diagonally; and may begin to establish hand preference or use of both hands (Tudor, 1981).

At the age of four, the child is able to fold a piece of paper diagonally. The preschooler starts to produce crude designs and letters and can also utilize scissors with some level of success (Tudor, 1981). By the time the child is five, he or she is able to combine past skills to produce drawings with some detail. For example, if a child draws a house, it may have windows, a chimney, and a door with a handle, etc. "The child learns how to make the alphabet by combining vertical, horizontal, diagonal, and circular lines

in the correct patterns" (Nuttall et al., 1992, p. 220). By the end of the fifth year the child is able to write his or her first name, although the letters may be reversed and poorly formed (Nuttall et al., 1992).

Gender and Motor Development

Although gender differences have been reported for numerous motor tasks, these differences are minimal during earliest childhood (Woodard & Surburg, 1997). During infancy there are no reported gender differences in motor skills. However, by the time preschool comes around, boys begin to surpass the girls in gross motor skills, and their excellence becomes more prominent by the time they reach preschool (Mondschein, Adolph, & Tamis, 2000). According to Sinclair, motor development in boys and girls is similar up until the age of four, with girls having a slight advantage over boys especially before age three (1973). It appears that by age four, boys surpass girls in tasks that require strength and throwing. More boys than girls at this age demonstrate all aspects of total body assembly. In 1973, Sinclair stated "at age three and after, boys are more proficient than girls in many motor tasks and this difference is maintained with great consistency and increasing superiority as the children grow older"(p. 58). Although the age in which boys and girls are able to do certain gross motor skills such as skip, gallop, and slide is roughly the same, girls accomplish proficiency and a basic pattern in these tasks more rapidly than boys. "A meta-analytic review of the literature indicates that boys outperform girls at all ages across a range of motor tasks and that for particular tasks (e.g., dash, sit-ups, long jump, and shuttle run) the gap in skill level increases with

age. Boys skills improve continuously between 7 and 17 years, but girls show only slight improvement after 12 years of age" (Mondschein et al., 2000, p.307). Biological and environmental factors are thought to contribute to such differences.

Further study of educational and developmental programs for the preschool years is suggested due to these sex differences found in the movement of young children. The number of underachievers, dropouts, children with mental retardation, and delinquents found among school age boys as compared with girls suggests serious mistakes in the present programs. "A study done on tastes and trends in early childhood indicates that boys prefer and may especially need a longer period of emphasis on gross movement and a later exposure to sedentary tasks and those requiring fine motor and precise eye-hand coordination than is now offered in our cultures" (Sinclair, 1973, p. 58).

Motor skill development is an extremely significant issue in the overall development of the child, "for often a failure to manifest appropriate motor behavior is a signal that cognitive function may be impaired" (Katz, 1982, p. 55). Keep in mind however, that no two children are alike in the speed or extent of their motor learning (Skinner, 1973). Children need both gross and fine motor skills for academic readiness; also, motor skills give children the self-confidence and feeling of success needed to move ahead in their education.

Purpose of Study

The main purpose of the present study is to determine whether there are gender differences in fine and gross motor abilities in preschool aged children.

Hypotheses

1. There is a gender difference in gross motor abilities.

2. There is a gender difference in fine motor abilities.

Method

Subjects

The subjects in this study consisted of 37 preschool aged children aged 2 to 5, with a mean age of 3.5. The study group was comprised of a random sample of children from Educare sites. The Educare children come from six counties in West Virginia; Cabell, Wayne, Monongalia, Roane, Upshur, and Webster. The subjects consisted of 21 males and 16 females.

Instruments

The Carolina Curriculum for Preschoolers with Special Needs

The Carolina Curriculum for Preschoolers with Special Needs (CCPSN) was used to assess the fine and gross motor abilities of the preschool children. The CCPSN is designed for the assessment and teaching children with mild to severe special needs from 2 to 5 years' developmental age. It can be used individually either in a home-or center-based program. The CCPSN does not require a special kit for implementation and can be administered by the classroom teacher; however, the teacher should be trained in administration.

The curriculum itself is divided into 25 logical teaching sequences covering five developmental domains: cognition, communication, social adaptation, fine motor, and gross motor. The assessment is essentially criterion referenced and is high in authenticity and emphasizes many natural occurring tasks. The CCPSN is among the best technical data of any curriculum. (Johnson-Martin, Attermeier, & Hacker, 1990).

Procedure

Data were collected by means of evaluation and assessment of preschool aged children during an approximated two-month period. Parental permission was obtained before observation and testing occurred. The Carolina Curriculum for Preschoolers with Special Needs (CCPSN) was administered to a random sample of preschool children in the West Virginia Educare pilot sites. The CCPSN was administered and scored by the classroom teacher. The CCPSN was used to determine fine and gross motor skills of the preschool children. The current study was part of a larger study done by graduate students at Marshall University Graduate College (MUGC) in South Charleston, West Virginia.

Results

After information was collected from the Educare Initiative, using subtest numbers 15a through 19-III-f from the Carolina Curriculum for Preschoolers with Special Needs, data was entered into SPSS, a comprehensive statistical software program. Two t tests were conducted. One t test was conducted to note any statistical significance of gender differences in gross motor abilities in preschool aged children. The second t test was conducted to note any statistical significance of gender differences in fine motor abilities in preschool aged children. Results of this study indicate that there was no statistically significant difference in gender in either gross abilities or fine motor abilities, rejecting both hypotheses (See Tables 2 and 4). The Independent Samples Test of Levene's Test for Equality of Variances was compiled for both gross and fine motor abilities (See Tables 3 and 5). For fine motor, the Levene's Test for Equality of Variances indicated a significance level of .654, and a significance level of .850 for gross

motor. Each significance level for both gross and fine motor abilities rules out any differences due to variance, or shape of the bell curve. The mean score for females in fine motor abilities 26.75, while for males it was 23.86. The mean score for females in gross motor abilities was 40.63, while for males it was 38.52 (See Figures 1 and 2).

Discussion

This study examined gender differences in gross and fine motor abilities in preschool aged children. The hypotheses of this study were that there are gender differences in gross and fine motor abilities in preschool aged children. The results of this study indicate that there are no significant differences in gross and fine motor abilities based on gender.

Areas for Further Research

This study identified several areas that need further research. First, although the children were randomly selected, how big of a cross selection do they actually represent? Second, do all of these children have the same socioeconomic background? Third, do the parents of these children have the same education level? Next, was the sample possibly stratified? Finally, could there have been problems with inter-rater reliability?

Limitations

Several limitations of the study should be considered when evaluating these results. Because the data were compiled from the West Virginia Educare Initiative, and only 10% of children were selected, the sample size was marginally small. Had the data set been larger, a more valid representation could have been established. Out of 107 children assessed by the Carolina Curriculum, only 37 were valid, leading to a restricted range of children in this study. A better cross section of children could have been

established if the preschools had been randomly selected, rather than chosen on the basis of Educare sites.

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Appendix A

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Variance
Gender	37	1	2	1.57	.50	.252
finetotl	37	4	51	25.11	12.81	163.988
grosstl	37	4	85	39.43	21.49	461.919
Valid N (listwise)	37					

Table 1

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
finetotl	Female	16	26.75	13.76	3.44
	Male	21	23.86	12.22	2.67

Table 2

	Levenes's Test for Equality of Variances	Levenes's Test for Equality of Variances	t-test for Equality of Means	t-test for Equality of Means	t-test for Equality of Means	t-test for Equality of Means	t-test for Equality of Means	t-test for Equality of Means 95% Confidence Interval of Difference	t-test for Equality of Means 95% Confidence Interval of Difference
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Finetotl									
Equal variances assumed	.205	.654	.676	35	.504	2.89	4.28	-5.80	11.59
Equal variances not assumed			.665	30.248	.511	2.89	4.35	-5.99	11.78

Table 3

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
grosstl	Female	16	40.63	22.13	5.53
	Male	21	38.52	21.50	4.69

Table 4

	Levenes's Test for Equality of Variances	Levenes's Test for Equality of Variances	t-test for Equality of Means	t-test for Equality of Means	t-test for Equality of Means	t-test for Equality of Means	t-test for Equality of Means	t-test for Equality of Means 95% Confidence Interval of Difference	t-test for Equality of Means 95% Confidence Interval of Difference
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
grosstotl									
Equal variances assumed	.036	.850	.291	35	.773	2.10	7.22	-12.57	16.77
Equal variances not assumed			.290	31.945	.774	2.10	7.25	-12.67	16.88

Table 5

Frequency Statistics

		Finetotal	Grosstotal	Gender
N	Valid	37	37	37
	Missing	0	0	0

Table 6

Fine Total Frequency Table

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
4	2	5.4	5.4	5.4
8	1	2.7	2.7	8.1
11	3	8.1	8.1	16.2
13	1	2.7	2.7	18.9
16	2	5.4	5.4	24.3
17	3	8.1	8.1	32.4
18	1	2.7	2.7	35.1
20	1	2.7	2.7	37.8
21	2	5.4	5.4	43.2
22	3	8.1	8.1	51.4
23	2	5.4	5.4	56.8
25	1	2.7	2.7	59.5
26	1	2.7	2.7	62.2
28	1	2.7	2.7	64.9
29	1	2.7	2.7	67.6
30	1	2.7	2.7	70.3
31	1	2.7	2.7	73.0
32	1	2.7	2.7	75.7
37	2	5.4	5.4	81.1
38	2	5.4	5.4	86.5
42	1	2.7	2.7	89.2
48	1	2.7	2.7	91.9
50	2	5.4	5.4	97.3
51	1	2.7	2.7	100.0
Total	37	100.0	100.0	

Table 7

Gross Total Frequency Table

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
4	1	2.7	2.7	2.7
11	2	5.4	5.4	8.1
15	1	2.7	2.7	10.8
18	1	2.7	2.7	13.5
19	2	5.4	5.4	18.9
21	2	5.4	5.4	24.3
22	1	2.7	2.7	27.0
25	1	2.7	2.7	29.7
28	3	8.1	8.1	37.8
29	2	5.4	5.4	43.2
30	1	2.7	2.7	45.9
33	2	5.4	5.4	51.4
36	1	2.7	2.7	54.1
38	1	2.7	2.7	56.8
41	1	2.7	2.7	59.5
42	1	2.7	2.7	62.2
45	2	5.4	5.4	67.6
50	1	2.7	2.7	70.3
55	1	2.7	2.7	73.0
56	3	8.1	8.1	81.1
61	1	2.7	2.7	83.8
65	1	2.7	2.7	86.5
70	1	2.7	2.7	89.2
75	1	2.7	2.7	91.9
76	1	2.7	2.7	94.6
83	1	2.7	2.7	97.3
85	1	2.7	2.7	100.0
Total	37	100.0	100.0	

Table 8

Gender

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Female	16	43.2	43.2	43.2
Male	21	56.8	56.8	100.0
Total	37	100.0	100.0	

Table 9

Appendix B

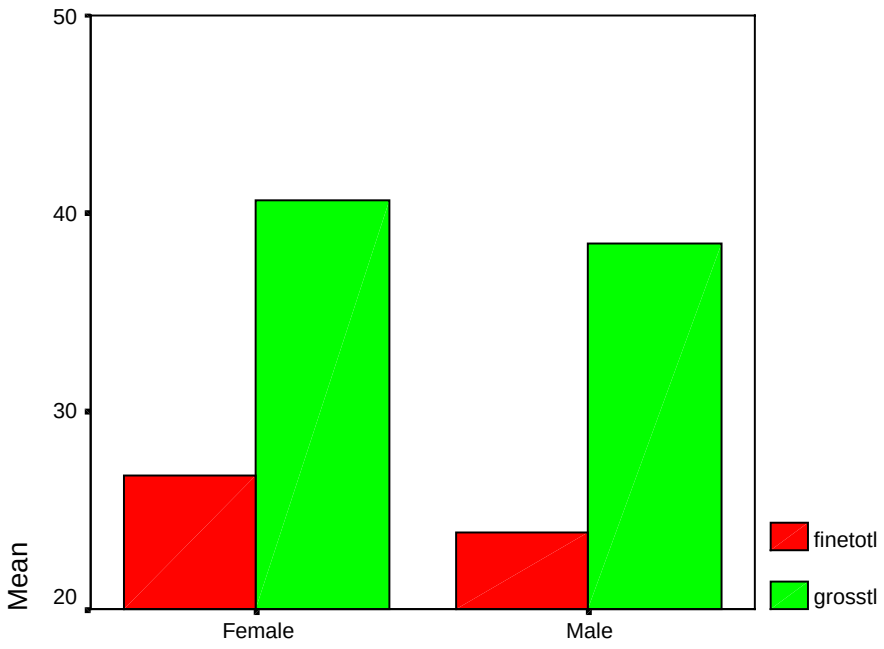

Figure 1

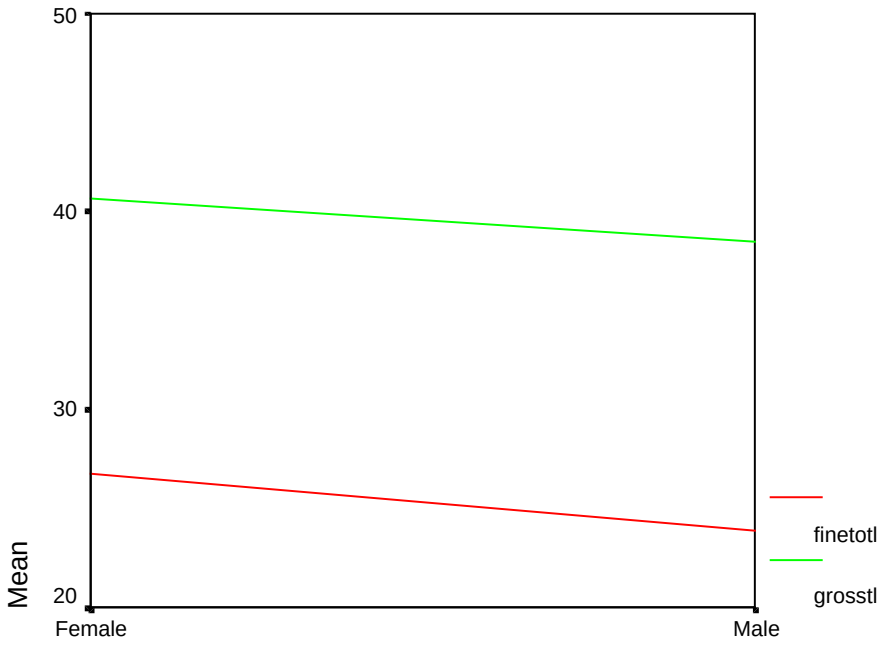

Figure 2